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APPLICATION
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FOR: LOAD DISTRIBUTING METHOD
AMONG GATEKEEPER

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LOAD DISTRIBUTING METHOD AMONG GATEKEEPER

Background of the Invention

1. Field of the Invention

5   The present invention relates to a gatekeeper and a load distributing method.

2. Description of the Related Art

In the so-called H323 network, i.e., a packet network in which service quality is not guaranteed and 10 which is defined in H323 recommendation of the ITU, address conversion and access control are provided to an end point on the network by a gatekeeper (GK). The end point is a terminal like s personal computer. The end point on such an H323 network issues a gatekeeper 15 discovery message to gatekeepers (GKs) on the network to look for one gatekeeper (GK) in which data of the end point is registered. When the plurality of gatekeepers (GKs) exist on the H323 network, each of the plurality of gatekeepers (GKs) receives the 20 gatekeeper discovery message and sends back to the end point, a message indicating that the gatekeeper is possible to register the data. When receiving from the plurality of gatekeepers (GKs), the messages indicating that the registration is possible, the end 25 point selects one of the plurality of gatekeepers (GKs) and carries out a subsequent process to the selected gatekeeper (GK).

In this way, in the conventional H323 network, when receiving the gatekeeper discovery message from the end point, the gatekeeper (GK) sends back the registration possible message to the end point, if the

5 gatekeeper (GK) is possible to register the data of the end point regardless of the condition of other gatekeepers (GKs). Therefore, there is a possibility that the load of a specific one of the plurality of gatekeepers (GKs) on the H323 network becomes heavy.

10 In this case, the loads of some gatekeepers (GK) become high extraordinarily, compared with the others, and the load of some gatekeepers (GK) become low extraordinarily, compared with the others. In such a case, though there is the plurality of gatekeepers

15 (GKs) on the H323 network, the processing ability of each gatekeeper (GK) is not sufficiently utilized.

In conjunction with the above description, a distributed data processing system is disclosed in Japanese Laid Open Patent application (JP-A-Heisei 7-

20 152702). In this reference, the distributed data processing system is composed of a plurality of terminal apparatuses and a plurality of data processing apparatuses possible to respond to processing requests from the terminal apparatuses,

25 which are connected with the terminal apparatuses through a network. The data processing apparatus has a load situation monitoring section and a load data

transmitting section. The load situation monitoring

section generates load data showing its own load

situation. The load data transmitting section

transmits back the load data obtained by the load

5   situation monitoring section in accordance with the

request from the terminal apparatus. One data

processing apparatus as a data management data

processing apparatus has a load data management

section and a load data inquiry processing section in

10   addition to the load situation monitoring section and

the load data transmitting section. The load data

management section manages the load data in the

plurality of data processing apparatuses. The load

data inquiry processing section notifies the load data

15   in accordance with an inquiry about the load data,

which are managed by the load data management section.

Each of the plurality of terminal apparatus has a

first load data inquiry section which inquires the

load data managed by the load data management section

20   of the management data processing apparatus in case of

a specific operation, a load data memory section which

stores the load data notified from the first load data

inquiry section in accordance with the load data

inquiry from the first load inquiry processing section,

25   and a load distribution control unit which distributes

the loads of the processing requests to the data

processing apparatuses based on the load data of the

data processing apparatuses stored in the load data memory section.

Also, an automatic call delivering system and a communication network is disclosed in Japanese Laid Open Patent Application (JP-P2000-32146A). In this reference, a call from a customer is routed to one or more service agents. A gateway is provided to receive a telephone call in the public telephone line network, and a gatekeeper is connected to the gateway through a computer network. The gatekeeper delivers the call from the gateway to one of a plurality of agent terminals connected to the computer network to connect one service agent with the customer. An automatic call delivering server is connected to the computer network, and determines when the agent is usable, and instruct the gatekeeper to route the agent terminal, which is usable from the gateway.

Also, a traffic distributing apparatus is disclosed in Japanese Laid Open Patent Application (JP-A-Heisei 7-235939). In this reference, the traffic distributing apparatus is composed of a plurality of networks (3), a terminating unit (2) connected to each network (3) and transmitting and receiving a communication frame and a routing frame, and a plurality of relaying units (1) interconnecting the plurality of networks to relay the frame. Each relaying unit (1) is composed of a receiving section

(11), a detecting section (15), a routing frame

processing section (12), and a transmitting section

(14). The receiving section (11) receives the

communication frame and the routing frame transmitted

5   from the terminating unit of a transmission source.

The detecting section (15) detects a traffic amount of

frames transmitted to the network of a transmission

destination. The routing frame processing section

(12) produces the routing frame to notify to the

10   terminating unit of each network At this time,

routing frame includes information of network entity

title indicative of a medium call control address

indicating an access point where the relaying unit is

connected to the network and an address allocated to

15   the relaying unit. Also, the routing frame processing

section (12) produces the routing frame indicative of

another relaying unit when the traffic amount exceeds

a predetermined value. The transmitting section (14)

transmits the communication frame to the transmission

20   destination terminating unit and transmits the routing

frame indicating the other relaying unit from the

routing frame processing section to the transmission

source terminating unit (2).

25   **Summary of the Invention**

Therefore, an object of the present invention

is to provide a gatekeeper and a load distributing

method, in which the load of the processing of end

points can be efficiently distributed.

Another object of the present invention is to

provide a gatekeeper and a load distributing method,

5 in which in an H323 network, it can be prevented that

the load concentrates to a specific gatekeeper so that

the efficiency is reduced.

In an aspect of the present invention, a

gatekeeper connected to an H323 network, includes a

10 gatekeeper discovery message receiving section, a

transport data transmitting section, and a control

section. The gatekeeper discovery message receiving

section receives a gatekeeper discovery message from

an end point. The control section determines whether

15 the gatekeeper has the lightest load among a plurality

of gatekeepers including the gatekeeper, and controls

the transport data transmitting section to transmit

transport data to the end point in response to the

gatekeeper discovery message, when it is determined

20 that the gatekeeper has the lightest load.

The control section controls the transport

data transmitting section not to transmit transport

data in response to the gatekeeper discovery message,

when it is determined that the gatekeeper does not

25 have the lightest load.

Also, the control section may include a

storage section and a first control section. The

storage section stores a load state list indicative of
existence of any of the plurality of gatekeepers
having lighter loads than the gatekeeper. The first
control section refers to the load state list to

5   determine whether the gatekeeper has the lightest load
among the plurality of gatekeepers including the
gatekeeper, and controls the transport data
transmitting section to transmit transport data to the
end point in response to the gatekeeper discovery

10   message, when it is determined that the gatekeeper has
the lightest load.

In this case, the control section may further
include a load state notice message receiving section,
a calculating section, and a second control section.

15   The load state notice message receiving section
receives a load state notice message from one of the
plurality of gatekeepers as a notice transmitting
gatekeeper, the load state notice message including a
load of the notice transmitting gatekeeper. The

20   calculating section which calculates a load of the
gatekeeper as a self-load. The second control section
extracts the load of the notice transmitting
gatekeeper from the load state notice message, and
compares the extracted load and the self-load, and

25   writes an identifier of the notice transmitting
gatekeeper at least into the load state list, when the
extracted load is lighter than the self-load.

In this case, the control section may further
include a load state request message transmitting
section. The second control section controls the load
state request message transmitting section to transmit
5 a load state request message with an identifier of the
gatekeeper and the self-load to each of the plurality
of gatekeepers. Each of the plurality of gatekeepers
selectively replies the load state notice message to
the gatekeeper based on a load of each of the
10 plurality of gatekeepers.

In this case, the control section may further
include a load state request message receiving section
and a load state notice message transmitting section.
The load state request message receiving section
15 receives the load state request message with an
identifier of each of the plurality of gatekeepers and
the load of each gatekeeper. The second control
section extracts the load of each gatekeeper from the
load state request message, and compares the extracted
20 load and the self-load, and controls the load state
notice message transmitting section to transmit a load
state notice message with the self-load and the
identifier of the gatekeeper to each gatekeeper, when
the extracted load is lighter than the self-load.

25 Also, the second control section discards the
load state request message, when the extracted load is
not lighter than the self-load.

In another aspect of the present invention, a load distributing method is applied to a communication system which include a network; an end point operatively connected to the network; and a plurality

5 of gatekeepers including first and second gatekeepers. The method is attained by (a) receiving a gatekeeper discovery message from the end point in the first gatekeeper; by (b) referring to a load state list which indicates identifiers of ones having lighter

10 loads, of the plurality of gatekeepers, in the first gatekeeper to determine whether the first gatekeeper has the lightest load among the plurality of gatekeepers; and by (c) transmitting transport data to the end point in response to the gatekeeper discovery

15 message in the first gatekeeper, when it is determined that the gatekeeper has the lightest load.

The load distributing method may further include the step of: (d) ignoring the gatekeeper discovery message, when it is determined that the

20 gatekeeper does not have the lightest load.

Also, the load distributing method may be attained by further including the steps of: calculating a load of the first gatekeeper as a first load; receiving a load state notice message including

25 a load of the second gatekeeper as a second load from the second gatekeeper; extracting the second load from the load state notice message; comparing the first

load and the second load; and writing an identifier of the second gatekeeper into the load state list, when the second load is lighter than the first load.

Also, a load state request message with an
5 identifier of the first gatekeeper and the first load may be transmitted to the second gatekeeper.

Also, the load distributing method may be attained by further include the steps of: receiving
10 the load state request message with an identifier of the second gatekeeper and the second load; extracting the second load from the load state request message; comparing the extracted second load and the first load; and transmitting a load state notice message
15 with the first load and the identifier of the first gatekeeper to the second gatekeeper, when the extracted second load is lighter than the first load.

In this case, the load state request message may be discarded, when the extracted second load is
20 not lighter than the first load.

Brief Description of the Drawings

Fig. 1 is a diagram showing an example of the configuration of an H323 network to which a gatekeeper
25 according to an embodiment of the present invention is applied; and

Fig. 2 is a block diagram showing the

configuration of the gatekeeper according to the
embodiment of the present invention.

Description of the Preferred Embodiments

5   Hereinafter, a gatekeeper and a load
distributing method of the present invention will be
described with reference to the attached drawings.

Fig. 1 shows an example of the outline
configuration of an H323 network to which the

10   gatekeeper according to the embodiment of the present
invention is applied. As shown in Fig. 1, the H323
network in this embodiment is composed of four
gatekeepers GK 1 to GK 4, a network 5 connected with
the gatekeepers GK 1 to GK 4, a plurality of gateways

15   (GWs) 6 and 8 connected with network 5, and end points
7 and 9 respectively connected with the plurality of
gateways 6 and 8. The configuration of the H323
network in this embodiment is composed of an element
group which is based on the H323 recommendation. It

20   should be noted that as in this embodiment shown in
Fig. 1, the end point is connected with the network
through the gateway. However, the present invention
is not limited to this, and the end point may be
connected directly with the network.

25   Fig. 2 is a block diagram showing the
configuration of the gatekeeper according to the
embodiment of the present invention. As shown in Fig.

1, in this embodiment, a case where the four

gatekeepers GK 1 to GK 4 are connected to the network

5 will be described. However, the gatekeepers GK 1 to

GK 4 have completely the same configuration.

5 Therefore, only the configuration of the gatekeeper GK

1 will be described with reference to Fig. 2.

     As shown in Fig. 2, the gatekeeper GK 1 is

composed of s load state request message transmitting

and receiving section 1, a load state data notice

10 message transmitting and receiving section 12, a load

state calculating section 13, a message control

section 14, a load state list generating section 15, a

memory section 16, a reply control section 17, a

gatekeeper (GK) discovery message receiving section 18,

15 and a transport data transmitting section 19.

     The load state request message transmitting

and receiving section 11 carries out a process of

receiving a load state request message from one of the

gatekeepers GK 2 to GK 4 and a process of transmitting

20 a load state request message to other gatekeepers GK 2

to GK 4. The load state data message transmitting and

receiving section 12 carries out a process of

receiving a load state data notice message from one of

gatekeepers GK 2 to GK 4 and a process of transmitting

25 a load state data message to other gatekeepers GK 2 to

GK 4. The load state calculating section 13

calculates the load state of the gatekeeper GK 1. The

message control section 14 extracts the received load

state data notice message or the received load state

request message and compares a load state contained in

the received load state request message with the

5 calculated load state of the gatekeeper GK 1. The

load state list generating section 15 generates a load

state list based on the comparing results of the

calculated load state of the gatekeeper GK 1 and the

load states contained in the received load state

10 request messages or load state notice messages. The

memory section 16 stores the load state list generated

by the load state list generating section 15. The

reply control section 17 controls transmission of a

reply to an end point based on the load state list

15 stored in the memory section 16. The gatekeeper (GK)

discovery message receiving section 18 receives a

gatekeeper (GK) discovery message from the end point.

The transport data transmitting section 19 transmits

transport data to the end point under the control of

20 the reply control section 17.

It should be noted that in this embodiment,

the load state request message uses a position data

request message (LRQ), which is defined in the H323

recommendation, and the load state data message uses a

25 position data response message (LCF), which is defined

in the H323 recommendation. Also, the gatekeeper (GK)

discovery message is GRQ in the H323 recommendation

and the transmission of the transport data is carried

out by use of GCF in the H323 recommendation.

Next, an operation of the gatekeeper in this

embodiment will be described below. As shown in Fig.

5 1, there are the four gatekeepers GK 1 to GK 4 on the

H323 network. Also, it is supposed that the load

state is 30% for the gatekeeper G1, the load state is

10% for the gatekeeper G2, the load state is 40% for

the gatekeeper G3, and the load state is 20% for the

10 gatekeeper G4. In this situation, the operation of

the gatekeeper G1 will be mainly described. It should

be noted that the load state is a ratio of the number

of actual registrations to the maximum number of

registrations which can be registered on each

15 gatekeeper (GK).

In the gatekeeper GK 1, the message control

section 14 controls the load state request message

transmitting and receiving section 11 to transmit a

load state request message from the load state request

20 message transmitting and receiving section 11 to each

of the gatekeepers GK 2 to GK 4 other than itself.

For example, this process is desirable to be

periodically executed to acquire the latest load

states of the other gatekeepers GK 2 to GK 4. Also,

25 the message control section 14 may refer to a

gatekeeper list stored in the memory section 16 to

determine the gatekeepers GK 2 to GK 4. The

respective gatekeepers GK 2 to GK 4 carry out the same process as the gatekeeper GK 1.

For the load state request message, a position data request (LRQ) message is used in case of

5 H323 recommendation, and the load state of the gatekeeper GK 1 is set as a nonStandard parameter of the LRQ message. Thus, the LRQ message is transmitted to the other gatekeepers GK 2 to GK 4.

Also, in the transmission of the load state

10 request message, a code indicating that a position data request (LRQ) message is an inquiry of the load state is set as gatekeeperIdentifier of the position data request (LRQ) message. It should be noted that the data of the gatekeeper GK 1 is set as the

15 transmitter data.

Each of the gatekeepers GK 2 to GK 4 receives the LRQ message as the load state request message from the gatekeeper GK 1 and recognizes that the LRQ message inquires the load state, based on the

20 gatekeeperIdentifier of the received LRQ message. Then, in each of the gatekeepers GK 2 to GK 4 as a concerned gatekeeper, the message is received by the load state request message transmitting and receiving section 11 and the message control section 11 takes

25 out the load state of the transmission source gatekeeper GK 1 from the nonStandard parameter of the LRQ message. The load state calculating section 13

calculates the load state of the concerned gatekeeper (GK).

Next, in each of the gatekeepers GK 2 to GK 4, the message control section 14 compares the calculated

5 load state and the taken out load state. When the load state of the concerned gatekeeper is lighter, the message control section 14 of the concerned gatekeeper (GK) sets the load state of the concerned gatekeeper (GK) to a nonStandard parameter of the position data

10 replying (LCF) message as the load state notice message. Then, the message control section 14 controls the load state notice message transmitting and receiving section 12 to transmit the load state notice message to the transmission source gatekeeper

15 (GK) of the load state request message (in this example, to the gatekeeper GK 1). At this time, the message control section 14 of the gatekeeper (GK) sets an identifier of the concerned gatekeeper as the message originator data of the load state notice

20 message. However, when the end point cannot be accommodated, the concerned gatekeeper (GK) discards the received load state request message and does not reply to the message.

Also, when the load state of the concerned

25 gatekeeper (GK) is equal to or higher than the load state of the transmission source gatekeeper GK 1 of the load state request message, the gatekeeper (GK)

discards the received load state request message and
does not reply to the message.

As described above, in this embodiment, it is
supposed that the load state of gatekeeper GK 1 is 30%,
5   the load state of the gatekeeper GK 2 is 10%, the load
state of the gatekeeper GK 3 is 40%, and the load
state of the gatekeeper GK 4 is 20%. Therefore, when
receiving the load state request message from the
gatekeeper GK 1, the gatekeeper GK 2 transmits the
10   load state data notice message to the gatekeeper GK 1.
However, when receiving the load state request message
from the gatekeeper GK 1, the gatekeeper GK 3 discards
the received load state request message and does not
reply. When receiving the load state request message
15   from the gatekeeper GK 1, the gatekeeper GK 4
transmits the load state data message to the
gatekeeper GK 1.

When receiving the load state data notice
message by the load state data notice message
20   transmitting and receiving section 12 from the
gatekeeper GK 2, the message control section 14 of the
gatekeeper GK 1 extracts the load state of the
gatekeeper GK 2 from the nonStandard parameter of the
LCF message as the received load state data message.
25   The load states of the gatekeepers GK 2 and GK 4 are
notified with the load state data messages in this way.

The load state of the gatekeeper GK 1 is

calculated by the load state calculating section 13

and transferred to the message control section 14,

which compares the calculated load state of the

gatekeeper GK 1 with the extracted load state. When

5   the extracted load state is lighter than the

calculated load state, the message control section 14

outputs the identifier of the received message to the

load state list generating section 15. When the

processing to the messages from all the gatekeepers GK

10   2 to GK 4 is ended, the load state list generating

section 15 generates a load state list and stores in

the memory section 16.

The present load states of the gatekeepers

are arranged in a lower order in the load state list.

15   In this case, because the load state of gatekeeper GK

3 is higher than the load state of the gatekeeper GK 1

as described above, the gatekeeper GK 3 does not reply

to the load state request message from the gatekeeper

GK 1. Therefore, the gatekeeper GK 1 cannot know the

20   load state of the gatekeeper GK 3 and the load state

of the gatekeeper GK 3 is not written in the load

state list stored in the memory section 16 of the

gatekeeper GK 1. However, any gatekeeper (GK) whose

identifier is not written in the load state list has

25   the load state heavier than that of the gatekeeper GK

1. Therefore, this is not a problem for the purpose

to find a gatekeeper (GK) with a lighter load state.

That is, the gatekeeper GK 1 does not receive the load
state data notice message from the gatekeeper GK 3 and
there is not the identifier of the gatekeeper GK 3 in
the load state list. Thus, the gatekeeper GK 1 can

5   know that the load state of the gatekeeper GK 3 is
heavier than the load state of the gatekeeper GK 1.

As described above, the load state list
generating section 15 of the gatekeeper GK 1 generates
the load state list and stores in the memory section

10 16. The reply control section 17 refers to the load
state list when the gatekeeper discovery message is
received from the end point 7 or 9 and determines
whether transport data should be transmitted to the
end point 7 or 9.

15   In more specifically, in the gatekeeper GK 1,
when receiving the gatekeeper (GK) discovery message
(GRQ) from the end point 7 or 9 by the gatekeeper
discovery message receiving section 18, the reply
control section 17 refers to the load state list

20 stored in the memory section 16 and determines whether
or not the gatekeeper GK 1 has the lightest load state
among the gatekeepers GK 1 to GK 4. If the load state
of the gatekeeper GK 1 is the lightest, the reply
control section 17 of the gatekeeper GK 1 controls the

25 transport data transmitting section 19 to transmit the
transport data to the end point 7 or 9 which has
issued the gatekeeper discovery message. Also, the

reply control section 17 controls the transport data
transmitting section 19 not to transmit the transport
data, if the load state of the gatekeeper GK 1 is not
the lightest. As described above, when the load state
5   of the gatekeeper GK 1 is 30%, the load state of the
gatekeeper GK 2 is 10%, the load state of the
gatekeeper GK 3 is 40%, and the load state of the
gatekeeper GK 4 is 20%. Therefore, the load state of
the gatekeeper GK 1 is not the lightest. Thus, the
10 transmission of the transport data is not carried out.

On the other hand, when there is no reply
from the gatekeepers GK 2 to GK 4 although the
gatekeeper GK 1 transmits the load state request
message to the other gatekeepers GK 2 to GK 4, the
15 load state of the gatekeeper GK 1 is the lightest,
compared with other gatekeepers GK 2 to GK 4.
Therefore, when receiving the gatekeeper (GK)
discovery message from the end point 7 or 9, the reply
control section 17 of the gatekeeper GK 1 controls the
20 transport data transmitting section 19 to transmit the
transport data of the gatekeeper (GK) to the
transmission source of the gatekeeper (GK) discovery
message.

As described above, according to the present
25 invention, it can be prevented that the load of the
processing for an end point centers on a specific one
of the gatekeepers in the H323 network so that the

efficiency is degraded. Thus, it is possible for the
load to be efficiently distributed. That is,
according to the present invention, each gatekeeper
(GK) connected with the network previously checks the

5   load states of the gatekeepers (GK), and transmits the
transport data in response to the gatekeeper (GK)
discovery message from the end point, only when the
load state of the gatekeeper (GK) is the lightest.
Therefore, the leaning of the load can be eliminated

10 between the plurality of gatekeepers (GKs) connected
with the network, and the gatekeeper (GK) can be
effectively used.